IEEE 802.11
Wireless LANs

Considerations Regarding Medium Characteristics and Capture Effect

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A considerable body of work has recently been published [1-4] that updates the historical performance projections for Slotted ALOHA access control methods taking into account capture effect. The results of these papers in conjunction with the work on channel characterization that has been already presented to the committee by variety of contributors (Maslied, Van Der Jagt, Mckown, Aschatz, Tuch, and to IEEE 802.4.L Rappaport) make a strong case for seriously evaluating Slotted ALOHA as an important alternative in any contention based portion of any access control proposal currently before IEEE 802.11.

In particular, it is has been well documented that signal strength will vary significantly over distances on the order of inches in the indoor environment. This means that signal level (or any other locally derived indicator that the medium is being used) at a station is not a reliable indicator of either:

1) The probability that the station desiring access to the medium will not be able to successfully transfer a PDU to its destination

or,

2) That by using the medium the station will interfere with the transmissions that are already in progress.

In the presence of strong capture effect in a PHY layer that will enhance the probability of successful PDU transmission possibly even in the presence of small or negative signal to interference ratios, and adaptive power control among participating stations, the usefulness of the above two statments is further enhanced.

A laymans example of this is the "cocktail party" scenario. At a cocktail party many groups of individuals are typically involved in simultaneous converstations that are

made possible by local capture effect and the adaptation of individual voice levels to the surrounding noise environment. If in this situation if a particular individual or group of individuals waited for silence (or anything reasonably close to silence) prior to attempting to a communicate it is clear that opportunities for communication that could have been successful would be lost.

Given that any allocation of spectrum to our efforts is contigent on our using that spectrum as efficently as possible (with efficency denominated in Megabits/second/cubic hectare/hz) the content and conclusions of these references should be carefully considered in our work.

[1] Robert K. Morrow, Jr. and James S. Lehnert, "Packet Throughput in Slotted ALOHA DS/SSMA Radio Systems with Random Signature Sequences", IEEE Transactions on Communications, vol. 40, pp. 1223-1230, July, 1992.

[2] Chiew T. Lau and Cyril Leung, "Capture Models for Mobile Packet Radio Networks", IEEE Transactions on Communications, vol.40, pp. 917-925, May, 1992.

[3] R. Clark Robertson and Tri T. Ha, "A Model for Local/Mobile Radio Communications with Correct Packet Capture", IEEE Transactions on Communications, vol.40 pp.847-854, April, 1992.

[4] Dimitiris Makrakis and K.M. Sundara Murthy, "Spread Slotted ALOHA Techniques for Mobile and Personal Satellite Communications Systems", IEEE Journal on Select Areas in Communications, vol. 10, pp 985-1002, August 1992.